



The first of the attack-concept airplanes built by Grumman was the XSBF-1, bearing a strong resemblance to the stubby fighter biplanes, the F2F- and F3F-. Only one was built. (Photo-GAEC 3115)

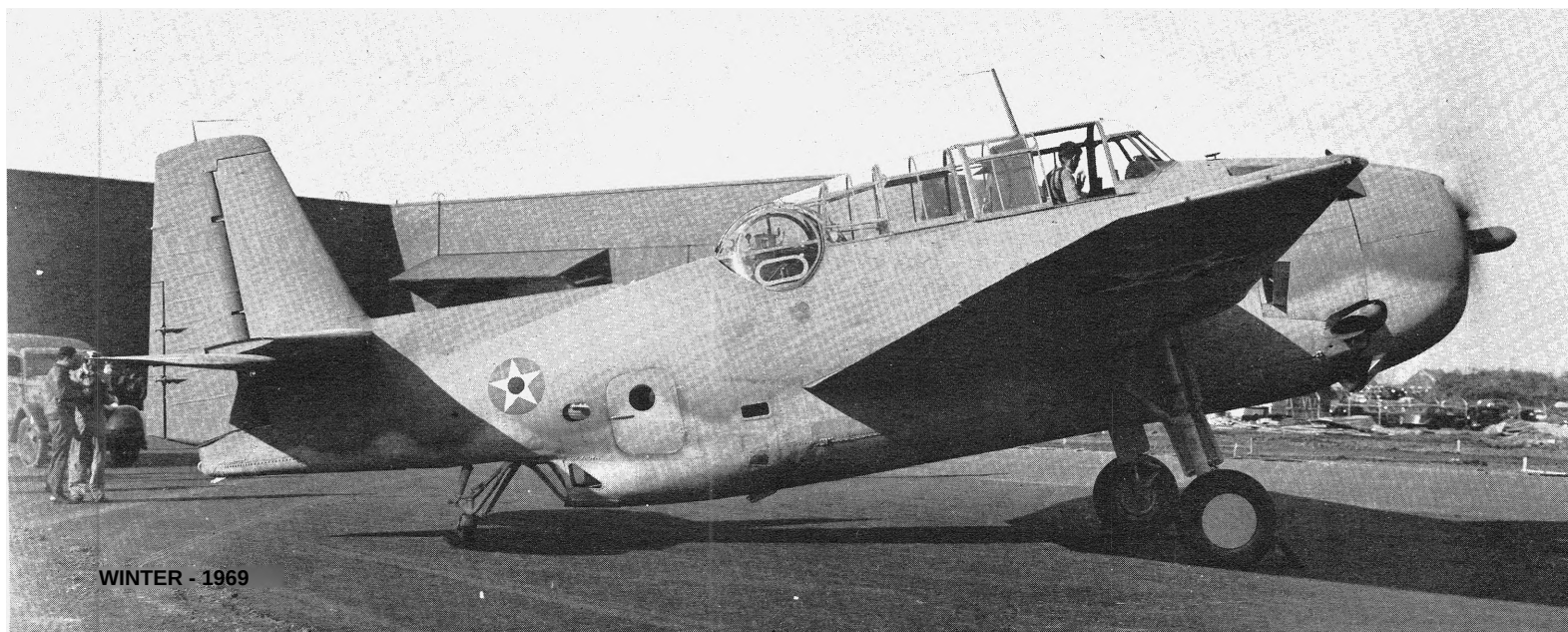
To many persons, Grumman and naval fighters will always remain synonymous. However, the Bethpage-based corporation also turned out its share of naval attack aircraft.

As U. S. Naval Aviation grew up in the lean 1930s and matured in the battles of the Atlantic and Pacific, Grumman studied, proposed and built airplanes that helped shape the outcome of World War II. Simultaneously, however, was the internal struggle in the Navy on just what constituted a dive, torpedo and horizontal bomber as well as a scouting aircraft. By today, both general purpose attack and antisubmarine warfare aircraft have emerged.

With this in mind, let's review Grumman's contribution to the attack airplane weapon. Following is a summary:

DESIGN NO.	YEAR	DESIGNA'
14	1936	XSBF-1
40	1939-1945	TBF
55	1943	XTB2F-1
66	1944	XTSF-1
70	1947-1950	XTB3F
82	1949-1953	AF-2
89,121	1949-1967	S-2
128	1957-Present	A-6

XTBF-1 number 2, parked here in the courtyard of the Grumman factory at Bethpage, was identical to number 1 except for the addition of the dorsal fin. It first flew on 20 Dec. 1941. (GAEC 8313)



GRUMAN ATTACK AIRCRAFT SINCE 1935

By KURT H. MISKA

The following paper was prepared for delivery at the Northeast Aero Historians Meeting, held on 11 October 1969 at Rhinebeck, N.Y. with sponsorship of the American Aviation Historical Society and other organizations. The author, Kurt H. Miska, served also on the steering committee for the meeting, and presented his paper under the auspices of the Long Island Early Flyers Club.

All photographs by Grumman Aircraft & Engineering Corp, courtesy of the Author.

THE XSBF-1

The sole XSBF-1 (BuNo 9996) took to the air for the first time in February 1936 with Bud Gillies at the controls. As were all of Grumman's airplanes of this period, it was a small, chunky two-seater biplane derived directly from the SXF-2 scout-fighter. Had it been procured in quantity it would have served as a land- or carrier-based scout suitable for use as a dive or light bomber and smoke layer.

By today's standards, the little biplane was a feather-weight at 3395 pounds empty. It weighed 5442 pounds as a bomber or 5000 pounds as a scout, with range and service ceiling being maximum as a scout.

The prototype, built at Grumman's Farmingdale, L.I., factory, was ferried to Naval Air Station Anacostia, D.C. on February 19, 1936 for Board of Inspection and Survey Trails, which took place the following week. Later, arresting and night flying tests at NAS Norfolk and bombing tests at the Naval Proving Grounds, Dahlgren, Va. proved that the aircraft was service suitable with a few minor modifications being needed.¹ However, the Navy had no funds for production aircraft and the XSBF-1 never joined the fleet.

THE AVENGER

In 1939 BuAer issued the requirement for a single-engine torpedo and horizontal bomber for use on board aircraft carriers. The type was to be capable of 300 mph at 15,000 feet and a range of nearly 1000 miles, most certainly an advance in the state of the art.

In April 1940 both Grumman and Chance-Vought were given the go-ahead to design and produce two experimental aircraft each, Grumman's XTBF-1 and Vought's XTBU-1. During the design and prototype phase, and under urgency of impending war Grumman received a production contract for 286 TBF-1s in December 1940. Both companies proceeded and shortly before America was plunged into the Second World War Robert "Bob" Hall, now a Grumman Vice President, lifted the XTBF-1 (BuNo 2539) off the Bethpage runway. That was August 7th.

A few weeks later, while on a routine stability test flight, the prototype caught fire and crashed near Brentwood, Long Island. The pilot, Hobart Cook, and Gordon Israel, engineer observer, both bailed out and the aircraft was a total loss.²

On Pearl Harbor Day Grumman was holding open house to dedicate a new plant. One wonders if the employees, seeing the new TBF on display, gave any thoughts to a name for the company's latest. Shortly after the news of Pearl Harbor reached the company, the aircraft had a name; it was simply — "Avenger," no doubt inspired by the spirit of the ensuing days.

Three days before Christmas 1941, the XTBF's competitor, the Chance-Vought XTBU-1 finally flew. Though neither Grumman's nor Chance-Vought's designs were troublefree, and the production TBF-1 exceeded its weight guarantee by nearly 1,000 pounds, BuAer chose to put the TBF into mass production. Of many reasons for delay of the XTBU, two major ones were a lack of enthusiasm for the project by Chance-Vought, and the fact that the Navy did not want to jeopardize the F4U Corsair program by overexpanding Chance-Vought. Subsequently Consolidated-Vultee was given the task of refining the XTBU and slowly they succeeded. But the airplane, redesignated TBV did not come off the assembly lines until 1944; by then, Grumman and Eastern Aircraft had delivered more than 8,000 TBFs and TBMs.

By early 1942, TBF production was well underway and the first production airplane was delivered to Anacostia on 30 Jan. 1942. Although nearly 100 RUDMs (Report of Unsatisfactory or Defective Material) were issued before the airplane left Norfolk, these concerned minor items, there were no major changes and few minor ones made between the experimental airplanes and the thousands that followed. The last of 2291 production TBFs left Bethpage on New Year's Eve 1943. Eastern Aircraft continued production, after having flown their first aircraft out of the Linden, N.J. factory on 12 Nov. 1942 and completed the last of them in September 1945.

When the "Avenger" reached operating squadrons, fighter pilots eyed the airplane and took note of its rather rotund and ungainly appearance as well as slow speed. It somehow reminded them of a turkey. It even seemed to waddle and, so, the TBF became the "Turkey." It was a heavy airplane but the fastest and only torpedo bomber in the Navy after Midway.

The Avenger went into action for the first time on 4 June 1942 at the Battle of Midway, the turning point of the Pacific war, from a shore-based detachment of Torpedo Squadron Eight (VT-8).³ The newspapers of the day were unanimous in putting the TBF debut on the front pages. The *New York Herald Tribune* of 16 June 1942 headlined the event "Midway Battle Won With New Torpedo Plane." What was not said is really more dramatic in that the torpedo units attacking the Japanese Fleet at

Midway were, in fact, decimated. Of the six TBFs launched, only one returned.

As the war progressed, TBF squadrons went from strength to strength. On 22 May 1943 Composite Squadron Nine (VC-9), operating off the escort carrier U.S.S. *BOGUE* attacked and sank the German submarine U-569 in the middle-north Atlantic; thus they scored the first sinking of the war by escort carriers on hunter-killer patrol. Another Atlantic Squadron was also responsible for a TBF first. On 11 Jan. 1944, TBF-1Cs of VC-58 flew from the U.S.S. *BLOCK ISLAND* and carried out the first American air-to-surface rocket attack, against a submarine but records do not indicate the success or failure of the mission.⁴

Yet another TBF first was racked up by the crews from VT-10. Twelve radar-equipped TBF-1Cs took to the air from the U.S.S. *ENTERPRISE* in February 1944 and in carrying out a strike against Truk made the first night bombing attack in the history of U. S. carrier aviation. The two Japanese superbattleships *YAMATO* and *MUSASHI* were also victims of TBFs and TBMs. The former was sunk by a bombing attack in April 1945 while the latter took three "fish" in October 1944. At the peak of operations the Navy had 111 TBF/TBM squadrons of 18 aircraft each including Atlantic and Pacific forces as well as the North African Theater of Operations.⁵ There were 19 TBF/TBM squadrons in Marine Corps inventory at the height of operations.

After the War the Avenger went into Naval Air Reserve use and was flown until phase-out in 1956. Likewise France, The Netherlands, Brazil, Uruguay, Canada, and Japan got many useful years out of these aircraft.

THE XTB2F-1 & THE XT5F

After negotiating for almost a year, Grumman's design 55, the XTB2F-1, to be powered by two R-2800-22 engines, was revealed in mockup form in late 1943. The design was based on the twin-engined F7F, and was to be an airplane with a three-man crew, a speed of 300 mph armed with four 2,000 pound bombs, two guns in each of two fuselage turrets, four guns in the wings and two in the nose.⁶ To achieve a 2280 mile patrol or scouting range, the aircraft would have to rely on external drop tanks in addition to the usual internal ones. As a scout, the XTB2F-1 would have had extensive camera equipment on board and remained aloft for nearly 14 hours.

As ever, weight - nearly 45,000 pounds at takeoff — raised its ugly head as Navy engineers inspected the mock-up in early 1944 and concluded that the aircraft would be far too heavy to operate from even the largest carriers then under construction. Naval Aircraft Historian Lee Pearson

The XTB2F-1 did not progress beyond one-sided wood mockup stage, (Observe shadow) due to its size and therefore limited total weapon delivery. (Photo — Grumman G-11076, 6-11-44)



wrote, in an analysis of the attack concept,

"Perhaps even more serious was the fact that while the XTB2F-1 would carry four 2000 pound bombs and two torpedoes and had a 3,700 mile range, so few of these airplanes could be operated from a carrier that the total load of bombs or torpedoes which could be delivered at one time would be less than if smaller airplanes were used."⁷

This spelled the end of the XTB2F-1.

In early 1944, BuAer asked Grumman about the possibility of making a torpedo airplane out of the F7F Tigercat. In August 1944, Grumman received authority to convert an F7F to the XTFSF-1, design 66. Since the former was nearly combat ready, it was hoped that the TSF would be ready very soon. Two prototypes were ordered and the Navy mockup board inspected a cockpit, partial bomb bay and radio compartment in October 1944. However, the project had several factors conspiring against it and soon its doom was sealed. The TSF would be too large to operate from the escort class carriers and an alternate proposal for a modified TBF strained Grumman's engineering effort to where only one of the two could proceed. Thus, the XTFSF-1 was cancelled in December 1944.

THE XTB3F & THE GUARDIANS

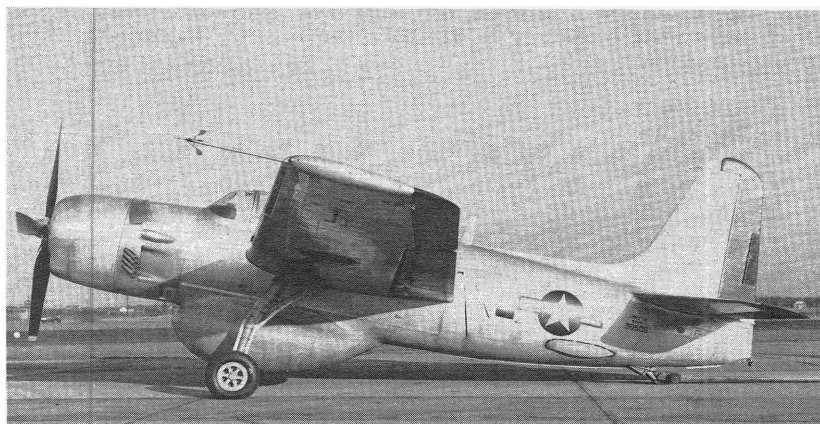
The potentials of the jet engine were not lost on Grumman and the Navy. In late 1944, BuAer decided to have Grumman install an auxiliary jet engine in a version of the TBF, called Design 70, the XTB3F-1. Prototypes were ordered in February 1945.

In place of defensive armament the airplane was equipped with a Westinghouse type 19XB-2B turbojet engine, of 1600 pounds thrust, to give it higher speed to escape pursuers. The aircraft (BuNo 90504), made its first flight on piston power alone on 19 Dec. 1945. The jet engine was never used in flight. Subsequently it was removed, making room for a ventral radar for submarine search. The airplane was later lost in a crash.

In Design 70 the Navy and Grumman had thought to use the Avenger technology as much as possible. The Pratt & Whitney R-2800-46 engine was used, and with side-by-side seating and other changes the concept broke away from the Avenger design.

Jet engines were not installed in the second and third prototypes and these became new configurations. XTB3F-1S (very briefly numbered XTB3F-2) was the "search half" while XTB3F-2S was the "attack half," a concept pioneered during the War with Wildcat/Avenger teams flown from escort carriers in the North Atlantic. Together the series

XTB3F-1S (BuNo 90506), the second prototype of the XTB3F series developed for antisubmarine warfare. The instrument boom on port wing was for accurate airspeed and angle of attack measurements.



evolved to the AF-2 Guardian hunter-killer teams.

After two evaluations by NATC, Patuxent River, in February and July 1949, these airplanes were considered ready for production. The production models were designated AF-2W and AF-2S. The AF-2W had a crew of four while the AF-2S seated three. The latter carried wing-mounted APS-30 radar, used to pin-point the target once it has been detected by the accompanying AF-2W. First flight of the AF-2S (BuNo 123089) was on 17 Nov. 1949 with "Corky" Meyer at the controls.*

The AFs were large airplanes to be operating off escort carriers. The wing measured over 60 feet and from prop to tail was a little more than 43 feet. They grossed out at 25,000 pounds. Armament for the AF-2S depended on the mission.

Board of Inspection and Survey Trials took place from May 1950 to November 1951 at NATC "Pax River." Carrier trials were intermittent due to tail wheel and fuselage structure problems.

They went aboard the WRIGHT in Nov. 1950, the PALAU in December and again in June 1951 and on the MONTEREY two months later. The most serious problem repeated modifications of the tail wheel and supporting fuselage structure delayed the trials. No arrested landings were permitted with the first six aircraft until new tail hook installations were completed.⁸

Operations with AF-2 aircraft commenced in October 1950, with delivery to Pacific Fleet Squadron VS-25 at NAS North Island, Calif. Other Pacific Fleet Squadrons to fly AF-2s were VS-21 and VS-37, and VS-23 flew these aircraft out of NAS Norfolk. Even though in service during the Korean War, they did not fire a shot in anger; their service consisted of ASW patrol duties in Korean waters.

THE TRACKER FAMILY

The concept of the composite aircraft and the hunter-killer team had certain inherent limitations and the Navy was well aware of these. The main objection centered around the fact that if one of the two aircraft had to abort its mission or was damaged or disabled, the remaining one would be useless.

Consequently, the Navy invitation to bid issued on 20 Jan. 1950 stated that the new antisubmarine attack aircraft was to carry all necessary weapons and search gear in a single vehicle, and that enough fuel for long search missions at low altitude was to be carried internally in the carrier suitable aircraft. Grumman emerged winner of the competition 2 June 1950.

Grumman Model 89, the XS2F-1, was named the Tracker. With Norman Coutant and Fred Rowley at the controls, the XS2F-1 (BuNo 129137) made its maiden flight on December 4, 1952. The Navy began evaluation in February 1953.

The project moved ahead and gradually the production, design began to emerge. Weapons were carried in the fuselage bomb bay and special chutes in the engine nacelles stored the sono buoys. The search radar was mounted in a retractable radome in the bottom of the aft fuselage. The magnetic anomaly detector was mounted in the tail and was extended only when required during search and localizing operations. Each wing has three store stations for additional weapons.

The first production S2F-1 (BuNo 129139) made its first flight on 7 July 1953. After many tests, including preliminary carrier suitability evaluation at NATC Pax River, the S2F went on board the MINDERO for carrier qualification. VS-26 accepted the first operational S2F-1 in February 1954; the squadron deployed aboard the U.S.S.

*Corwin H. Meyer, now Vice President, Production, GAEC.



No mistake that this is the search half of the submarine hunter-killer team, the AF-2W Guardian. The engine was the R-2800-48W of 2400 hp. (Photo — GAEC G-38580)

PRINCETON.⁹

Though the S2F was produced solely for the U. S. Navy by Grumman, they were supplied to Allies under MAP (the Military Assistance Program). S-2As were modified for operation from land bases for Italy, Japan, Brazil, The Netherlands, Argentina, Uruguay, Nationalist China and Thailand. DeHavilland of Canada built them under license for the Canadian Navy and also delivered some to Dutch Forces. A total of 755 S2Fs were built and to this day the type (now designated S-2A) is operated by the Reserves and Training Command.

The S2F-1S differed from the S2F-1 in that it featured the AN/AQA-3 "Jezebel" passive long - range acoustic search equipment and its associated "Julie" explosive echo-sounding equipment. 60 S2F-2s that followed featured a larger homing torpedo.

When the Navy asked Grumman to propose a more modern S2F in October 1957, the company responded at once with the highly updated S2F-3, with the name Tracker retained. Contract award came in December 1957. The prototype S2F-3 (BuNo 147531) was taken on its first flight by Tommie Attridge on 20 May 1959.

At first sight the aircraft resembled the S2F-1 but physically it was a much larger aircraft. The fuselage provided more working room and made it more comfortable for the four-man crew, two pilots and two ASW Systems operators, and 16 instead of 8 sonobuoys.

Two Navy Preliminary Evaluations were held, the first in Sept. 1959 and a second in February 1960. Carrier suitability was proven on the INTREPID and the KEAR-

S2F-1 Tracker, later redesignated S-2A, used Wright R-1820-76 in prototype, the R-1820-82 in production. Right, the later and larger

SARGE. All "fixes" were incorporated and the first squadron aircraft was accepted by VS-41, at NAS North Island in late October 1960.

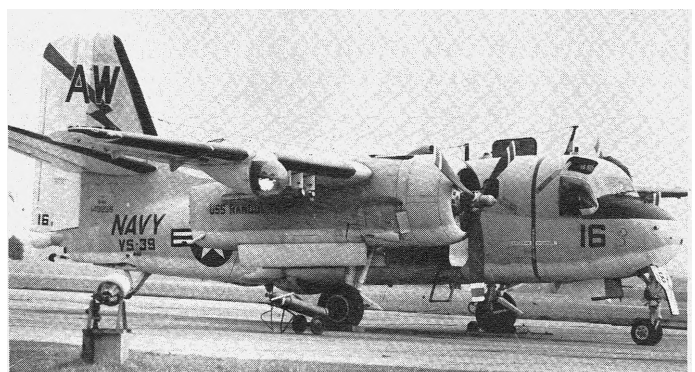
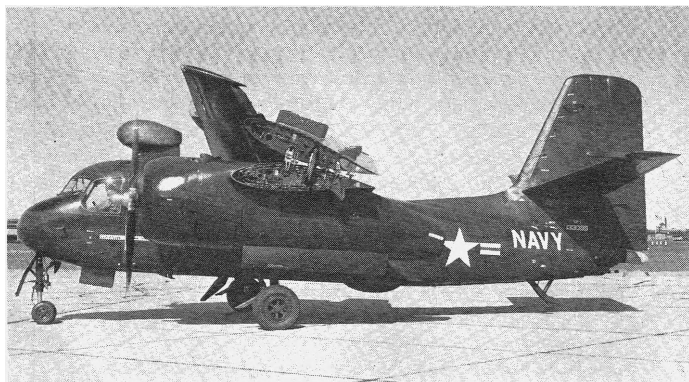
The last variant of the S2F family, in 1962 redesignated the S-2, is the currently operational S-2E with the latest in airborne ASW avionics. With delivery, via the Navy, of 14 S-2Es to the Royal Australian Navy, the S-2 production line at Grumman came to an end. Counting all models, almost 1500 were produced. At present a turbo-prop conversion of the S-2 could gain momentum if the contemplated removal of av gas from aircraft carriers takes place.

THE INTRUDER

The Navy issued requests in 1956 for proposals for a new all-weather attack airplane to fill the void between the A-4 light and the A-3/A-5 heavy attack aircraft. New avionics, as well as cockpit displays resulted in the concept of an integrated bombing-navigation system promising the much sought after all-weather capability. The Naval Air Systems Command (formerly BuAer) wanted the new type to be able to fly long distances at low altitude by night, finding and attacking both moving and stationary targets and returning to the aircraft carrier without the aid of external navigational references.¹⁰

Of 18 companies solicited, 13 responded. Grumman's design 128 was selected the winner on the last day of 1957. The A2F-1 Intruder was to have a rocky road ahead of it.

S-2D (was S2F-3) of VS-39, the "Hoot Owls" Squadron. Engines were Pratt & Whitney R-1820-82A. (Photo — Ken Buchanan)



In March 1959, Grumman received a development contract for four airplanes. The engineering mockup was completed and accepted in September. Four more were ordered in March 1960. The first A2F-1 (BuNo 147864) made its first flight, with Robert Smyth at the controls, on 19 April, 1960. Now redesignated the A-6, contracts came slowly; 24 were allotted in Fiscal Year 1962 and 43 more in FY63. There also was an order for 12 electronic countermeasure version designated as the EA-6A, probably the most complex aircraft built by Grumman to date. And there were many engineering changes in the first batch of 20 aircraft completed by the end of 1962.

The basic A-6 accommodates a crew of two, side-by-side. There are no flight controls for the right seat man, the bombardier/navigator. Its performance is subsonic but its range is transoceanic without flight refueling. It carries all stores, up to 18,000 pounds of ordnance, on four wing hard points and one fuselage store station. In an attempt at STOL performance, it was decided to incorporate moveable tailpipes, to duct the exhaust downward 23 degrees with the intent to reduce landing and take-off speeds. Although the system was trouble-free, performance gains were too marginal to justify the complexity and the idea was dropped after the fourth airplane. The next four had provisions only for the system.¹¹

Of great importance is the heart of the A-6A, the Digital Integrated Attack and Navigation Equipment (DIANE). Using DIANE, the crew can fly against pre-selected or targets of opportunity, with a variety of ordnance loads, over any kind of terrain, and under varying tactical conditions.

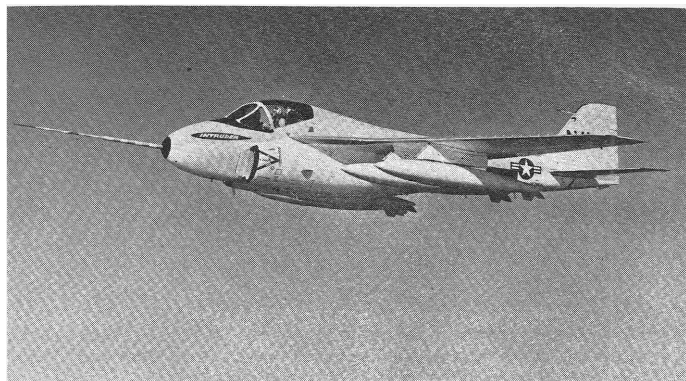
In June 1965 the impressive ferry range of the A-6A was demonstrated. An airplane assigned to NATC Pax River was flown non-stop from Calverton, L.I. to Le Bourget, Paris, in 7 hours 20 minutes, with five external drop tanks.

Later, in 1966, the Marines chose to ferry their A-6As across the Pacific. The Batmen of VMA-242 and Composite Reconnaissance Squadron Two, flying the EA-6A, left MCAS El Toro, Calif, for Hawaii, Wake Island and NAS Atsugi, Japan before finally landing at the Marine base at Da Nang, South Vietnam.

There are now over 20 squadrons, and Grumman has gone ahead with other versions to fulfill other mission requirements. The first mention of an A-6B came in the latter part of 1964. That version was to be a simple day-light bomber, an A-6A minus the all-weather avionics; the contract was subsequently cancelled.

And finally after having managed to cram 35 years of history into this draft, it was suggested that one attack aircraft was missed completely, Grumman's venerable Ag-Cat. It attacks boll weevils in cotton patches!

The first A2F-1, BuNo 157864, with instrument test boom. Later designated A-6 Intruder, it has many versions including KA-6D



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APPENDIX "A"

In 1962 the armed services adopted a unified designation system. Two aircraft in this position were subject to this redesignation; these are the aircraft in the S-2 series and the early A-6A models. These aircraft have been redesignated as follows:

Pre 1962	1962 and subsequent
XS2F-1	none
S2F-1	S-2A
S2F-1S	S-2B
S2F-2	S-2C
S2F-3	S-2D
S2F-3S	S-2E
A2F-1	A-6A
A2F-1H	EA-6A

ACKNOWLEDGEMENTS

Special thanks go to those at Grumman who have helped with leads to follow up, provided look at special documents and verified much of this presentation. Also, thanks to Berkley Jackson of A.A.H.S. for invaluable assistance with the Avenger portion and to Lee Pearson and Adrian Van Wyen of the Navy Department for their help on the attack concept in general.

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tanker. Engines are Pratt & Whitney J52-P-8A turbojets. And at right, last but not least, the Ag-Cat is the attacker of boll weevils.

